'Clean' set of claims:

1. A sensor (100), characterized in that the sensor comprises:

a conduit (106) configured for conveying a material (F), the conduit presenting an axial length,

the conduit having a noncircular cross-section of major axis (a) and minor axis (b) of respective dimensions (a) and (b) each taken as perpendiculars with respect to the axial length, wherein the cross-section tends to become slightly more circular as pressure internal to the conduit is increased;

a vibrator (118, 126) configured for vibrating the conduit along a first cross-sectional axis and for vibrating the conduit along a second cross-sectional axis;

a sensor (114, 122) configured for detecting a first frequency along the first cross-sectional axis (a) and for detecting a second frequency along the second cross-sectional axis (b); and

a processor (400) configured for determining a pressure of the material based on a ratio of the first frequency and the second frequency~~.~~;

wherein the ratio is related to the pressure through first and second inertial moments according to an equation having a form of

$$\text{(Eq.2)}\quad \frac{(\mathit{firstfrequency})^2}{(\mathrm{sec}\mathit{ondfrequency})^2} = \frac{I_a}{I_b}, \text{where}$$

I_a is the first inertial moment and I_b is the second inertial moment.

2. The sensor of claim 1, wherein the conduit comprises a cross-section selected from one of an elliptical shape and an oval shape.

5. The sensor of claim 1, wherein the first inertial moment has a form of

$$\text{(Eq.5)}\ I_a = \frac{\pi}{4}\left((b+\delta_b)(a+\delta_a)^3 - ((b+\delta_b-t)(a+\delta_a-t)^3\right), \text{where}$$

b is a length of one half the second cross-sectional axis, δ_b is a displacement for the second cross-sectional axis, a is a length of one half the first cross-sectional

axis, δ_a is a displacement for the first cross-sectional axis and t is a conduit wall thickness.

6. The sensor of claim 1, wherein the pressure linearly corresponds (500) to the ratio of the first and the second frequencies.

7. The sensor of claim 1, wherein the conduit is elastically deformable to change a length of the second cross-sectional axis based on the pressure of the material.

9. The sensor of claim 1, wherein the processor further comprises a calculation module (406) configured for determining a density of the material from one of:

a calculation of the pressure, a pressure compensation factor, and one of the first frequency and the second frequency, and

a calculation of an average of the first frequency and the second frequency.

10. The sensor of claim 9, further comprising:

a temperature sensor (108) configured for detecting a temperature of the material conveyed through the conduit and for generating a temperature control signal for processing by the processor; and

a timing controller (430) configured for synchronizing the processing of the temperature control signal with the determining of the density.

11. The sensor of claim 1, further comprising a frequency sensor (114, 122) configured for detecting a phase difference in at least one of the first and the second frequencies, wherein the processor is further adapted to determine a mass flow rate of the material based on the phase difference.

12. A method of measuring a property of a material (F) conveyed through a conduit (106), the conduit presenting an axial length and a noncircular cross-section of major axis (a) and minor axis (b) of respective dimensions (a)

and (b) each taken as perpendiculars with respect to the axial length, wherein the cross-section tends to become slightly more circular as pressure internal to the conduit is increased, the method characterized in that the method comprises:

vibrating the conduit along a first cross-sectional axis (a);

vibrating the conduit along a second cross-sectional axis (b);

detecting a first resonant frequency along the first cross-sectional axis in response to vibrating the conduit at the first cross-sectional axis;

detecting a second resonant frequency at the second cross-sectional axis in response to vibrating the conduit along the second cross-sectional axis; and

determining a pressure of the material based on a ratio of the first resonant frequency and the second resonant frequency~~.~~;

wherein determining comprises determining a first inertial moment and a second inertial moment according to an equation having a form of

$$\text{(Eq.2)}\quad \frac{(firstfrequency)^2}{(secondfrequency)^2} = \frac{I_a}{I_b}, \text{where}$$

I_a is the first inertial moment and I_b is the second inertial moment.

13. The method of claim 12, wherein vibrating the conduit along the first cross-sectional axis comprises vibrating the conduit along the first cross-sectional axis of an elliptically-shaped cross-section of the conduit.

14. The method of claim 12, wherein vibrating the conduit along the first cross-sectional axis comprises vibrating the conduit along the first cross-sectional axis of an oval-shaped cross-section of the conduit.

16. The method of claim 12, wherein determining further comprises determining the first inertial moment according to an equation having a form of

$$\text{(Eq. 5)}\ I_a = \frac{\pi}{4}\left((b+\delta_b)(a+\delta_a)^3 - ((b+\delta_b-t)(a+\delta_a-t)^3\right), \text{where}$$

b is a length of one half the second cross-sectional axis, δ_b is a displacement for the second cross-sectional axis, a is a length of one half the first cross-sectional

axis, δ_a is a displacement for the first cross-sectional axis and t is a conduit wall thickness.

17. The method of claim 12, wherein determining comprises determining the pressure by linearly corresponding the pressure to a ratio of the first and the second frequencies.

18. The method of claim 12, further comprising conveying the material through the conduit, wherein conveying comprises elastically deforming the conduit to change a length of the second cross-sectional axis based on the pressure of the material.

19. The method of claim 12, wherein detecting comprises converting the first resonant frequency and the second resonant frequency into digital representations of the first resonant frequency and the second resonant frequency.

20. The method of claim 19, wherein determining comprises processing the digital representations of the first resonant frequency and the second resonant frequency to determine the pressure of the material based on the squared ratio of the first resonant frequency and the second resonant frequency.

21. The method of claim 12, further comprising determining a density of the material from one of:

a calculation of the pressure, a pressure compensation factor, and one of the first frequency and the second resonant frequency (Eq. 9); and

a calculation of an average of the first resonant frequency and the second frequency (Eq. 8).

22. The sensor of claim 21, further comprising: detecting a temperature of the material and generating a temperature control signal in response to detecting the temperature; and

processing the temperature control signal with the digital representations of the first resonant frequency and the second resonant frequency in a substantially synchronous manner to determine the density of the material.

23. The method of claim 12, further comprising:

detecting a phase difference in at least one of the first and the second resonant frequencies (Eq. 10); and

determining a mass flow rate of the material based on the phase difference (Eq.11).

24. A sensor (100), characterized in that the sensor comprises:

a vibrator (118, 126) configured for vibrating the conduit along a first cross-sectional axis and for vibrating the conduit along a second cross-sectional axis;

a sensor (114, 122) configured for detecting a first frequency along the first cross-sectional axis (a) and for detecting a second frequency along the second cross-sectional axis (b); and

a processor (400) configured for determining a pressure of the material based on a ratio of the first frequency and the second frequency

wherein the ratio is related to the pressure through first and second inertial moments according to an equation having a form of

$$\text{(Eq.2)} \quad \frac{(firstfrequency)^2}{(\text{sec}ondfrequency)^2} = \frac{I_a}{I_b}, \text{where}$$

I_a is the first inertial moment and I_b is the second inertial moment.

25. The sensor of claim 24, wherein the first inertial moment has a form of

$$\text{(Eq.5)} \; I_a = \frac{\pi}{4}\left((b+\delta_b)(a+\delta_a)^3 - ((b+\delta_b-t)(a+\delta_a-t)^3\right), \text{where}$$

b is a length of one half the second cross-sectional axis, δ_b is a displacement for the second cross-sectional axis, *a* is a length of one half the first cross-sectional axis, δ_a is a displacement for the first cross-sectional axis and *t* is a conduit wall thickness.

26. A method of measuring a property of a material (F) conveyed through a conduit (106), characterized in that the method comprises:

vibrating the conduit along a first cross-sectional axis (a);

vibrating the conduit along a second cross-sectional axis (b);

detecting a first resonant frequency along the first cross-sectional axis in response to vibrating the conduit at the first cross-sectional axis;

detecting a second resonant frequency at the second cross-sectional axis in response to vibrating the conduit along the second cross-sectional axis; and

determining a pressure of the material based on a ratio of the first resonant frequency and the second resonant frequency,

wherein determining comprises determining a first inertial moment and a second inertial moment according to an equation having a form of

$$\text{(Eq.2)} \quad \frac{(firstfrequency)^2}{(secondfrequency)^2} = \frac{I_a}{I_b}, \text{where}$$

I_a is the first inertial moment and I_b is the second inertial moment.

27. The method of claim 26, wherein determining further comprises determining the first inertial moment according to an equation having a form of

$$\text{(Eq. 5)} \; I_a = \frac{\pi}{4}\left((b+\delta_b)(a+\delta_a)^3 - ((b+\delta_b-t)(a+\delta_a-t)^3\right), \text{where}$$

b is a length of one half the second cross-sectional axis, δ_b is a displacement for the second cross-sectional axis, *a* is a length of one half the first cross-sectional axis, δ_a is a displacement for the first cross-sectional axis and *t* is a conduit wall thickness.